

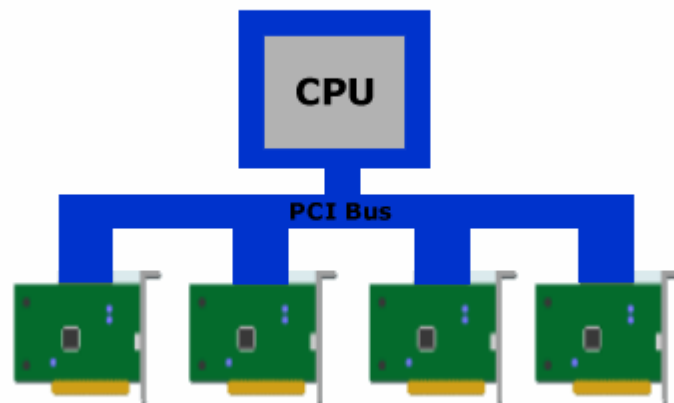
What is PCI-X and PCI-E and Why are they better than PCI?

What's wrong with PCI?

PCI, or Peripheral Component Interconnect was developed by Intel in 1992 and is the local bus used in most PCs until now.

PCI uses a shared bus topology to allow for communication among the different devices on the bus i.e. the different PCI devices are attached to the same bus, and share the bandwidth.

This diagram explains the situation.



It can run at clock speeds of 33 or 66 MHz. At 32 bits and 33 MHz, it will yield a throughput rate of 133 MBps which is too slow to cater for the latest frame grabbers especially as even this is shared with other PCI devices.

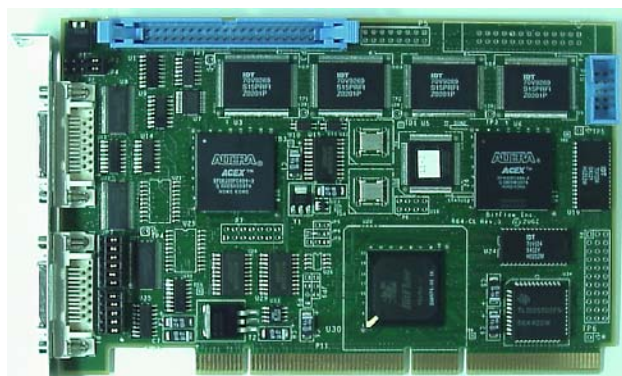
Why is PCI-X an improvement?

PCI-X stands for PCI Extended.

The PCI-X spec essentially doubled the bus width from 32 bits to 64 bits, thereby increasing bandwidth. The PCI's basic clock rate is increased to 66MHz with a 133MHz variety on the high end, providing another boost to the bandwidth and bringing it up to 1GB/s (at 133MHz).

Having said this PCI-X still suffers from the problem of Shared bus topology and also the faster a bus runs, the more sensitive it becomes to background noise. For this reason manufacturing standards for high-speed buses are exceptionally strict and therefore expensive. The PCI-x slot is physically longer than a PCI Slot.

A Bitflow R64 PCI-X frame grabber.

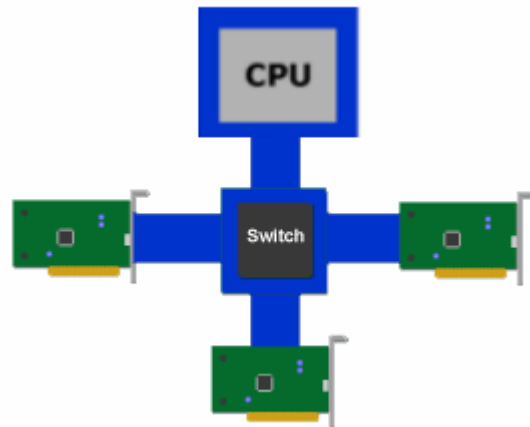


Is PCI-E any better?

PCI-E stands for PCI Express and is also known as 3GIO (Third Generation I/O). The most fundamental improvement is the adoption of point-to-point bus topology.

In a point-to-point bus topology, a shared switch replaces the shared bus as the single shared resource by means of which all of the devices communicate. Unlike in a shared bus topology, where the devices must collectively arbitrate among themselves for use of the bus, each device in the system has direct and exclusive access to the switch.

Compare this diagram of Point to Point topology with the shared bus topology diagram above.



The connections between the devices and the switch is called a link and each link consists of a number of lanes. Each lane is able to carry data in both directions. The gain in bandwidth is considerable as each lane can carry 2.5Gps in each direction.

The PCI Express slot is available in versions of from 1 lane to 32 lanes and are called x1, x2, x4, x8, x16 and x32. The slot and connector are different lengths for each version.

A Bitflow R64 PCI-E frame grabber (Example of x8).



Is PCI obsolete?

At least for the time being, PCs are being produced with PCI-X and PCI-E slots as additional to PCI slots.

Summary of bandwidth capabilities

Type	Bandwidth	Mbytes/s
PCI	32 bit / 33 MHz	132
PCI	64 bit / 66 MHz	533
PCI-X	64 bit / 66 MHz	533
PCI-X	64 bit / 100 MHz	800
PCI-X	64 bit / 133 MHz	1066
	Peak unidirectional bandwidth	Full Duplex Bandwidth
PCI-E x1	250 MBytes/s	500 Mbytes/s
PCI-E x2	500 MBytes/s	1 GBytes/s
PCI-E x4	1 GBytes/s	2 GBytes/s
PCI-E x6	2 GBytes/s	4 GBytes/s
PCI-E x16	4 GBytes/s	8 GBytes/s
PCI-E x32	8 GBytes/s	16 GBytes/s

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